

## THE TREATMENT OF DIFFUSE SUPPURATIVE PERITONITIS, FOLLOWING APPENDICITIS.\*

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THERE is perhaps no question in modern surgery of greater interest and importance and about which there is greater disagreement than that of the treatment of diffuse peritonitis.

The utter impossibility of draining the general peritoneal cavity does not seem sufficiently obvious to many surgeons, and the nature of the peritoneal reaction to drainage is but imperfectly understood.

The writings upon this subject consequently, have often been more or less tinged with prejudice, and only too frequently with an apparent lack of comprehension of the physiology and mechanics of peritoneal absorption. The peritoneum is generally regarded as a vast lymphatic space of great absorptive power, but Muscatello has shown that the older theories of absorption, through the so-called stomata, between the endothelial cells, was wrong; and that the stomata were merely artefacts. He showed, also, that the greater part of the peritoneal sac is not underlaid with lymphatic spaces, but that these are confined principally to the peritoneum covering the diaphragm. He demonstrated moreover, that there is normally a flow of lymph toward the diaphragm, and that this is uninfluenced, save in point of time, by gravity. The same observer also noted that colored particles in fluid, experimentally injected into the peritoneum, were taken up, first, into the pits of the dia-

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phragmatic peritoneum, and then into the lymph spaces beneath it by means of phagocytes.

To show the rapidity of peritoneal absorption, Dubar and Remy were able to recover particles of carmine, from the thoracic duct only seven minutes after intraperitoneal injection.

The irritation of the peritoneum by foreign substances becomes then the signal for the immediate delivery into the peritoneal cavity of a large quantity of phagocytes, whose number depends largely upon the character of the irritant, as well as, to some extent, upon the time elapsed.

Provided the endothelium is uninjured, bacteria and other foreign substances can be safely disposed of, within limits of course, by the lymphatic route through the crura and central tendon of the diaphragm. Damage to the endothelium, however, may at once lay open the vascular route through opened blood-vessels, and permit of absorption sufficient to cause a fatal septicaemia. This is believed by some observers to be a real danger in peritonitis.

Fortunately, however, the patient's safety in peritonitis does not depend solely on the integrity of the endothelium for there is also, in most cases, a protective fibrinous deposit, gross or microscopical, which limits absorption into the peritoneal blood-vessels, and, at the same time, prevents the further egress of germs from the lumen of the intestine. The absence of this fibrinous deposit, noted in bad cases of streptococcus infection, denotes the absence of an important barrier to general infection through the blood-stream, and the fatality of these cases as is well known, is disproportionately great. This great power of peritoneal absorption then is one of the factors upon which we must depend for comparative safety in all abdominal operations, and upon its proper conservation depends the surgeon's success or failure.

That which happens as a result of the introduction of micro-organisms into the peritoneal cavity, depends upon their virulence and power to damage the endothelium and

so gain access to the tissues beneath, upon the power of the individual to furnish a competent protective leucocytosis, upon the stimulating action of the body fluids, and upon the ability of the phagocytes to deal with the organisms. (Dudgeon and Sargent.)

As appearances at operation furnish no very exact information as to the extent of the peritonitis present, it has been thought best by the writer to indicate in a general way what class of cases he has collected for discussion.

1. In all cases free pus was present, and its limits were not generally definable.

2. The ability to wash out pus from the pelvis, splenic pouch, and various parts of the lower abdomen was taken as evidence of involvement of the peritoneum in those regions.

3. Large secondary encapsulated pelvic collections of pus are not included.

The cases under consideration include all those cases of diffuse purulent peritonitis in which the limits of the pus are extensive but not easily definable, and in which it is free and unencapsulated, except of course, within wide limits. A reference to the histories of the cases appended will show a number of primary diffuse suppurations, a number secondary to the rupture of primary appendiceal abscesses, and in all of them it will be observed that the process is extensive, diffuse, purulent, and rapidly generalizing.

The review of the rise and fall in the popularity of peritoneal drainage is well presented by Yates,<sup>1</sup> of Chicago, in a masterly paper on "An experimental study of the local effects of peritoneal drainage." He details most graphically the methods in vogue from the time of Celsus to the present, and notes the influence of the earlier operators upon later methods of procedure. His conclusions derived from a most careful series of experimental studies in animals, are so closely in accord with my own, which have been

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<sup>1</sup>Surgery, Gynecology and Obstetrics, December, 1905.

reached as a result of clinical observation, that I can only recommend a careful study of the whole article.

The experimental work of Clarke, confirming the earlier demonstration of Muscatello, as to the rapidity and efficiency of the absorption of micro-organisms through the lymphatic spaces of the diaphragm, is well known. The discussion and interest evoked by the paper of Blake on the treatment of peritonitis before the American Surgical Society two years ago, the work of Morris, Murphy, McCosh, and others, is also well known. The criticisms of my own methods of treatment as given in a paper read in March, 1904, before the Buffalo Academy of Medicine, "A consideration of the question of drainage in cases of acute appendicitis with spreading peritonitis," show that the question is by no means settled in the minds of the majority of the profession. Hence the variation of procedure from the method of Ochsner, who aims at encapsulation, and late removal of the appendix, to the radical methods still in vogue in this country and abroad, of wide incisions, evisceration, and washing and draining of the peritoneum. The general feeling seems to be, when in doubt drain, but the factor of doubt becomes at once a personal one, based often not upon any strong conviction but upon the following out of routine methods, and taking very little consideration of the physiology of peritoneal absorption, or settled by prejudice in favor of some method which has yielded fairly good results.

Men who have departed from the beaten track of belief as to the efficacy of intraperitoneal drainage by gauze or other means, and who have claimed better results by radically different methods, have been doubted and assailed. In my paper of March, 1904, already referred to, I reported 114 cases of appendicitis, in the service of a single hospital. In the first group extending over my terms of service from 1895 to 1899, there were 42 operations, among which there were 12 cases of diffuse peritonitis with 11 deaths. These latter cases were treated as was common at the time, by

free opening, more or less evisceration, saline irrigation, and drainage.

The second group, 72 cases from 1899 to 1903, showed 15 cases of spreading peritonitis with no mortality. These were treated by rapid removal of the appendix, generally through the muscle split of McBurney with as little traumatism as possible, developing the appendix by touch often rather than by sight, and discarding the broad protective packings of gauze to prevent soiling. Free irrigation of the pelvis and lower abdomen with hot normal saline solution, was done and closure of the wound to a small cigarette drain to the pelvis and appendiceal site. Before completing the work upon this series of cases, it had become evident to me that the cigarette drain or drains by reason of their rapid encapsulation acted mainly as a wound drain and had no real function as a peritoneal drain when it was possible to remove all local necrosis. Relying upon this clinical experience, the writer believes that the peritoneal drain can be eliminated as a factor of importance in the treatment of diffuse suppurative peritonitis. The observations of Blake, LeBoutillier and others will, I think, bear me out in this.

In the series of cases reported herewith and which have been operated upon since the beginning of 1903, 28 cases in all of diffuse suppurative peritonitis, the method of procedure has been as follows:

The McBurney muscle split, with or without the Weir extension through the posterior sheath of the rectus, has generally been found sufficient for the necessary manipulations.

As little ether as possible has been administered, and every effort has been made to complete all peritoneal work with as much speed and as little traumatism as possible. The appendix has been systematically searched for and removed with as little disturbance to the intestines as need be. After its removal and the cleansing of the appendiceal site, the pelvis and lower abdomen have been rapidly washed out with the Blake tube or the jacketted glass return-flow

canula. The peritoneum has been closed in many cases, without attempting to remove the saline solution which had not run out. Drainage of the external wound down to the peritoneum has generally been employed, from the fact that the wound is generally infected and needs it. Gastric lavage is given before the patient leaves the table, and as a rule an ounce or two of saturated solution of Epsom salts has been introduced through the tube and left in the stomach. Morphia as far as possible has not been given and the rectal tube with saline irrigation of the lower bowel has been used generally every six to eight hours for the first two days. If vomiting occurs, the stomach is washed out.

It has required some courage based upon strong conviction to close the peritoneum in these cases even when feeling sure that no area of local necrosis was left behind; but the results seem to have justified the means, and the writer feels that the mortality has been much diminished and the time in hospital much lessened, a factor of no inconsiderable importance. The Fowler position, based, as it seems to me, on entirely false premises as to the ability to pool and drain the peritoneal secretions, is nevertheless often a most valuable aid in that it increases the comfort of those patients in whom the distention of the bowel makes breathing difficult by upward pressure upon the diaphragm.

The use of saline irrigations to the peritoneum, as described, through the small lateral incision, does not consume much time, and seems by diluting the remaining fluids to hasten their absorption, besides acting generally as any intravenous infusion would to hasten the removal of toxins by dilution besides stimulating the heart and circulation. Moreover, the actual ability of the peritoneum to cope with the inflammation seems to be increased and not hindered. In those cases where the inflamed appendix is the cause of the peritonitis, the problem resolves itself into the rapid removal of the offending organ without evisceration, in all cases. The peritoneum has proven itself abundantly able to take care of the resulting inflammation, and drainage in

the absence of local necrosis is often ill advised and not based upon sound physiology or mechanics. Gauze packing is not only unnecessary but frequently harmful, being probably responsible for increased mortality, not to speak of the incident damage to the endothelium, with the resulting adhesions.

Where there is an area of local necrosis which is not removable it must of course be isolated, and the area drained on general surgical principles. Of course there is a point in all cases beyond which any interference is useless, as the patient is generally septic and dies whatever may be done. The factor of personal resistance is always an unknown quantity, and cannot be accurately estimated. The virulence of the infection unquestionably cuts an important figure in all cases, but this also is not to be determined at the time of operation, and the surgeon has to deal with the conditions present in each case and rely upon the resistance furnished by the individual phagocytosis and try and not disturb or upset the natural reparative powers by unnecessary traumatism in handling or exposing the intestines.

The experience of Murphy in dealing with these cases by rapid removal of the appendix through the lateral incision, the making of a small median incision and introducing a drain into the pelvis and sitting the patient up is very suggestive. While this method may seem to differ widely from the one herein detailed, the essential part in each seems to lie in the rapid appendectomy with minimum of trauma and exposure, and the reliance upon the peritoneal leucocytosis to accomplish the rest, the relief of tension alone in some cases being unquestionably all that is necessary to prevent further absorption and extension. The work of Clarke and Norris seems to show that saline solution within the peritoneum does not increase but minimizes the danger of pyogenic infections. In addition to the reduction of mortality, the convalescence of the patient is certainly rendered much more comfortable by reason of the rapid elimination of ether from the circulation, the reduction of

thirst, and the increase in the secretion of urine diminishing the bladder irritation.

The following brief reports will indicate exactly in what class of cases the writer has employed the treatment detailed.

The whole number of cases of diffuse peritonitis reported is 28, of which 5 died. Of these at least 3 were practically moribund, one had probably pneumonia present at the time of operation, and one was the subject of an extensive lung tuberculosis, in addition to an extensive perforative peritonitis in which no tendency to the formation of limiting adhesions was present.

These 28 cases in addition to the 15 already reported, in which a similar mode of operating was adopted, form a group of 43 cases of diffuse suppurative peritonitis resulting from appendicitis, with a mortality of 5, or a little over 10 per cent.; a creditable showing, when the class of cases, in which there must always be an appreciable mortality, is considered.

The writer does not believe that the treatment of these cases has yet reached the most satisfactory solution, but he does believe that the secret of success lies in the rapid removal of the cause with as little possible interference as may be, with the great natural protective forces of the peritoneum, the avoidance of drainage which in many cases may prove a menace instead of a help, and in relying upon the great natural powers of the inflamed peritoneum to cope with the infection.

#### SYNOPSIS OF CASES.

I. *Fatal Cases.* 1.—Ruth N., aged 7, admitted to Hood Wright Hospital April 20, 1903. Died April 21, 1903. Acute seizure, twenty-four hours; no vomiting, moderate distention, general tenderness, no mass. Rales present both sides of chest, condition very poor. McBurney incision with Weirs extension. Appendectomy. Free, thin, flaky pus everywhere; intestines, no adhesions; peritoneum washed out; cigarette drain to appendiceal site. Continued to sink, and died in a few hours.

2.—Lizzie A., acute appendicitis, general suppurative peritonitis. Oblique incision, free pus everywhere, no odor; small perforation of appendix, no gangrene. Patient very sick. Quick operation. Appendectomy. Peritoneal lavage; drain. Died. Hood Wright Hospital, December 9, 1903.

3.—Mr. L., aged 40, subject of extensive lung tuberculosis; acute perforative appendicitis, twelve hours before. McBurney incision; large perforation of appendix, well generalized peritonitis; washed out with Blake tube; peritoneum closed; gastric lavage; Epsom salts. June 10, 1905.—Died of urinary suppression and sepsis, June 15, 1905. Roosevelt Hospital.

4.—Florence B., aged 17; sick one week; left-sided pain. Very sick; marked distention, face and extremities congested, temperature  $104^{\circ}$ ; pulse 130; urine shows albumen and casts. Immediate operation. Incision through right rectus. Cæcum well to left; appendix perforated and exuding faeces. Appendectomy. Free pus everywhere. Saline irrigation with Blake tube; cigarette drain to stump. Died seven hours later. Roosevelt Hospital. August 16, 1905.

5.—Female, aged 42; Roosevelt Hospital September 18, 1905. Perforated appendix, well generalized suppurative peritonitis, W. B. C. 14000. Feeble pulse, cold extremities. McBurney incision; appendectomy. Irrigation with Blake's tube; gastric lavage; cigarette drain to site of appendix. Operation, 15 minutes. Died.

II. *Cases which Recovered.* 1.—Josephine H., aged 12, Hood Wright Hospital, March 13, 1903. First attack, fourth day. McBurney incision; appendectomy. Appendix perforated and gangrenous, free pus pelvis and left side, no limiting adhesions. Washed out with normal saline solution; gastric lavage, Epsom salts introduced through tube; cigarette drain to stump. Discharged well, April 5, 1903.

2.—Henry D., June 30, 1903. Subacute onset, then sudden severe pain and rapid peritoneal involvement; temperature  $101^{\circ}$ ; pulse 123; respiration 32. McBurney incision, appendectomy. Appendix, gangrenous, perforated, concretion. Free pus washed out from below liver, pelvis, and left side; cigarette drain to stump; gastric lavage, with Epsom salts left in stomach. Discharged well, August 10, 1903.

3.—Acute appendicitis; advancing suppurative peritonitis; Roosevelt Hospital, August 12, 1903. Appendectomy, through McBurney incision; washing out with Blake tube, peritoneum closed by suture; external wound drained by cigarette. Cured. August 12, 1903.

4.—Child; acute appendicitis, free pus. Appendectomy; McBurney incision; irrigation with Blake tube; peritoneum closed; wound drained. Cured. Roosevelt Hospital. August 24, 1903.

5.—Male, aged 10; perforative gangrenous appendicitis, acute seizure; collapse, followed by pain, etc. McBurney incision with Weir extension. Appendectomy. Local abscess about appendix, which was gangrenous, and perforated; free pus; peritoneal irrigation with hot saline; peritoneum closed; wound drained. Cured. Hood Wright Hospital. October 13, 1903.

6.—Dwight C., aged 10; acute perforative gangrenous appendicitis; fecal concretion; free pus. McBurney incision; peritoneal irrigation; gastric lavage; drain. Cured. October 16, 1903.

7.—Florence D., acute gangrenous appendicitis; perforation spreading purulent peritonitis. McBurney incision; appendectomy. Saline irrigation; free stinking pus; cigarette drain. Cured. December 26, 1903.

8.—John K., aged 16; acute appendicitis; free pus, also large retrocecal abscess. McBurney incision, with Weirs extension; saline irrigation of peritoneum, also lumbar drain for retrocecal abscess. Secondary operation for secondary peritoneal pus collections. Cured, 51 days. December 27, 1903.

9.—Leo G., gangrenous perforative appendicitis abscess, advancing purulent peritonitis. McBurney incision; appendectomy. Free thin pus widespread; irrigation; peritoneum closed. Cured. January 5, 1904.

10.—Maggie J., aged 25. November 30, 1904. Gangrenous appendicitis, perforative; spreading purulent peritonitis. McBurney incision; irrigation; peritoneum closed. External wound drained. Cured.

11.—Mr. S., aged 58, seen in consultation fourth day; acute appendicitis; tender both sides; marked abdominal distention. To Roosevelt Hospital. Immediate operation. Mc-

Burney incision; appendectomy. Large amount of free pus under pressure spurted out; appendix had multiple perforations; widespread peritonitis practically entire lower abdomen. Blake tube irrigation, gastric lavage, with salts, repeated next day; cigarette drain to stump. Discharged well, March 4, 1904—3 weeks.

12.—Edwin M., aged 16. Roosevelt Hospital. June 12, 1904. Pain both sides; vomiting, belly full of pus; no adhesions. Blake's tube, washed out pus in all directions. McBurney incision; Weir extension; gastric lavage, with salts; peritoneum closed; external wound drained. Cured, no complications.

13.—John M., aged 55. Cutchogue, L. I. July 9, 1904. Fourth day; legs drawn up, distended and tender; very sick. McBurney incision; appendix perforated and gangrenous; removed. Free pus from pelvis to spleen; washed out rapidly; gastric lavage, with salts; peritoneum closed. Cured.

14.—Man, aged 42. Roosevelt Hospital, October 17, 1904. Perforated appendix; extensive purulent peritonitis. Appendix broken off; gut opened and sutured; free pus washed out with Blake tube from pelvis, left and right sides. Temperature  $105^{\circ}$ , pulse 180; bad condition; gastric lavage before and after operation; cigarette drain. Temperature fell to normal next day. Cured.

15.—Boy, aged 7. Roosevelt Hospital. October 18, 1904. Acute appendicitis. McBurney incision; saline irrigation, Blake's tube; pus pretty widely diffused, both sides; gastric lavage; peritoneum closed. Cured.

16.—Mary D., aged 14. September 12, 1904. Gangrenous perforative appendicitis; free pus throughout pelvis and lower abdomen. McBurney incision; appendix removed; irrigation with Blake's tube; gastric lavage, with salts; cigarette drain. Cured.

17.—Hood Wright Hospital, November 30, 1904. Perforative gangrenous appendicitis; spreading suppurative peritonitis. Free pus washed out of pelvis and left side; no limiting adhesions. McBurney incision; peritoneum closed; wound drained. Cured.

18.—Roosevelt Hospital, June 2, 1905. Perforated gangrenous appendix; free pus. McBurney incision; appendec-

tomy. Irrigation with Blake tube; gastric lavage, with salts; peritoneum closed. Cured.

19.—Boy, aged 12. Acute gangrenous appendicitis, perforation, free pus throughout lower abdomen, no adhesions, McBurney incision; appendectomy. Blake tube; gastric lavage; peritoneum closed. Cured.

20.—Female, aged 6. September 18, 1905. Acute perforative appendicitis; spreading purulent peritonitis. Appendectomy; McBurney incision. Free pus washed out of pelvis, left and right side; no limiting adhesions, cigarette drain to stump. Cured.

21.—Gangrenous appendicitis; spreading purulent peritonitis. November 27, 1905. Hood Wright Hospital. McBurney incision; appendectomy. Appendix torn off at stump and left; free pus throughout pelvis and lower abdomen; saline irrigation; drain to stump. Recovery.

22.—Male, aged 28. August 20, 1905. Roosevelt Hospital. Perforative appendicitis; spreading purulent peritonitis. Blake's tube; free pus washed out from pelvis and left side; lavage. McBurney incision; appendectomy; drain to stump. Cured.

23.—Female. September 15, 1903. Acute gangrenous appendicitis; perforation; advancing purulent peritonitis. McBurney incision; irrigation of peritoneum with Blake tube; appendix tied off; cigarette drain to site. Cured.